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# Water Sustainability & Conservation in an Exhaust Cooling Discharge System Case Study

## 17 Jun 10


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# Report Documentation Page

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# Component Research Air Facility (CRAF)

- **Simulates high altitude conditions for aircraft and aviation fuels research**
- **Exhaust >3000 F at flows >36,000 cfm**
- **Cooled by water to 100 F**
- **Up to 1000 gpm water flow**

# Challenge

- **Design an Exhaust Cooling Discharge System (ECDS)**
  - **Treat free product**
  - **Treat emulsified fuel in water**
  - **Treat 300,000 gallons of water/research effort**
  - **Efficiently cool while limiting wastes**
  - **Determine viability of using fuel contaminated water to cool**
  - **Determine ability to recycle the water**
  - **Work within existing infrastructure**

# Technologies Evaluated

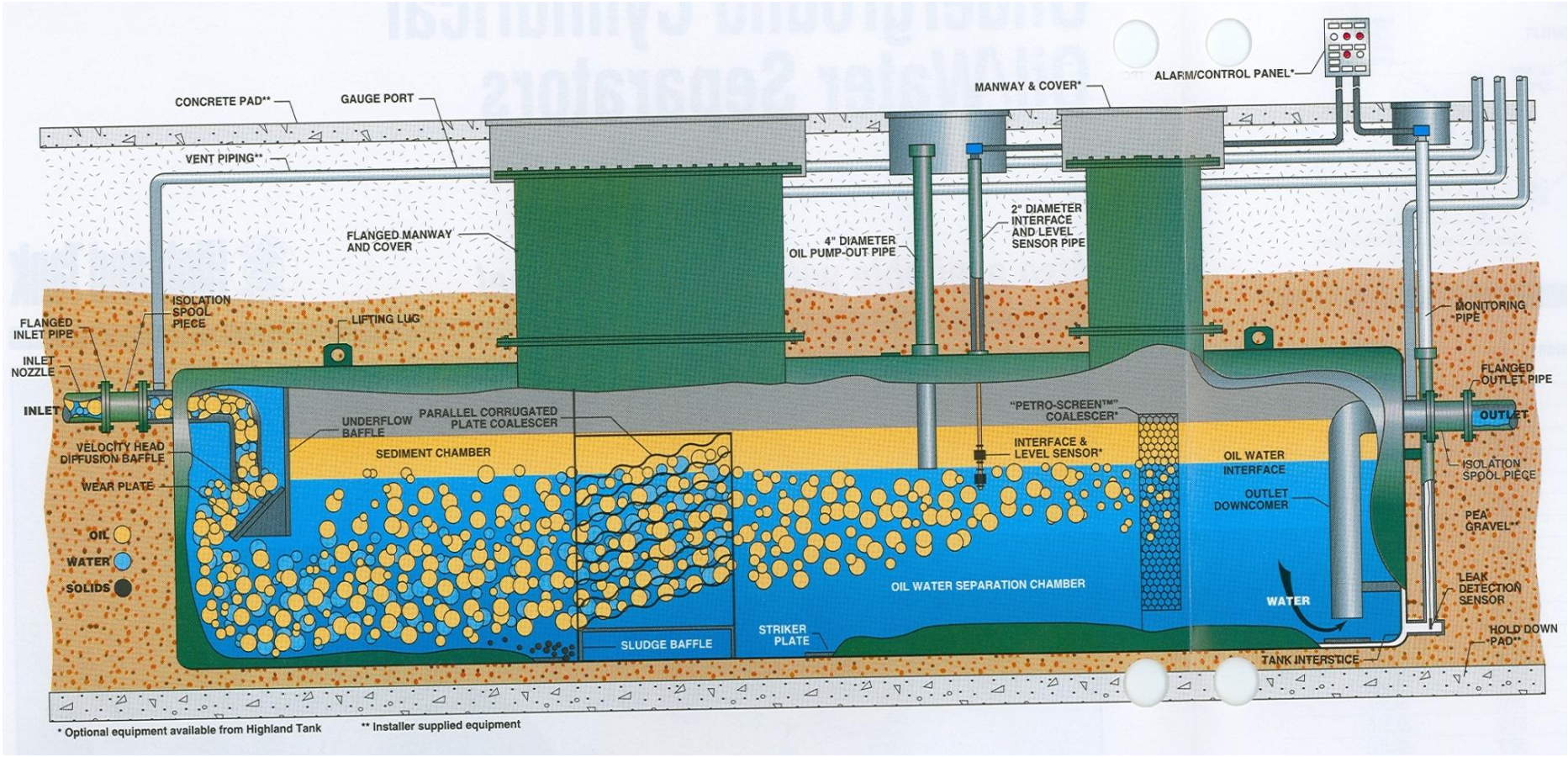
- Oil/Water Separator (OWS)
- Air-Sparged Hydrocyclone
- Direct Sanitary Discharge
- Diffused Air Flotation (DAF)
- OWS & Clay Towers – discharge to storm or sanitary
- OWS & Clay Towers – closed loop system

# Ranking Parameters

- **Initial cost**
- **Recurring annual cost**
- **Installation cost**
- **Risk**

# Oil/Water Separator

- Mechanical separation of oil and water
- Pros
  - Separates free product
- Cons
  - Cannot separate emulsified fuels


CONCRETE PAD**
GAUGE PORT
VENT PIPING**
MANWAY & COVER*
ALARM/CONTROL PANEL*
FLANGED MANWAY AND COVER
4" DIAMETER OIL PUMP-OUT PIPE
2" DIAMETER INTERFACE AND LEVEL SENSOR PIPE
ISOLATION SPOOL PIECE
LIFTING LUG
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PARALLEL CORRUGATED PLATE COALESCER
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OIL WATER INTERFACE
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OIL WATER SEPARATION CHAMBER
LEAK DETECTION SENSOR
WATER
SLUDGE BAFFLE
STRIKER PLATE
HOLD DOWN PAD**
TANK INTERSTICE
* Optional equipment available from Highland Tank
** Installer supplied equipment

# Air-Sparged Hydrocyclone

- Removes hydrophobic particles from aqueous solutions
- Vehicle wash racks & engine test cells
- Pros
  - High removal of oil & grease
- Cons
  - Low flows 20 gpm – 250 gpm

# Direct Sanitary Discharge

- **OWS – Separates free product – discharge to sanitary**
- **Pros**
  - **No EPA compliance monitoring**
  - **No waste disposal**
  - **No chemical handling**
- **Cons**
  - **Existing line too small**
  - **Disposal costs for sewage (present & future)**
  - **Lack of water conservation**

# Diffused Air Flotation

- Chemicals used to flocculate emulsified fuels
- Air bubbles raise fuel to surface
- Pros
  - Meets compliance levels for storm water discharge
- Cons
  - Large footprint needed
  - Recurring waste production –sludge disposal
  - EPA compliance monitoring (storm water)
  - Chemical purchases and handling

# OWS & Clay Towers – Discharge to Storm or Sanitary

- OWS – removes free product
- Clay towers – remove emulsified fuel
- Pros
  - Can meet storm water compliance
  - No chemical handling
- Cons
  - Replacement of clay & waste disposal
  - Compliance monitoring
  - Freezing problems

# OWS & Clay Towers – Closed Loop

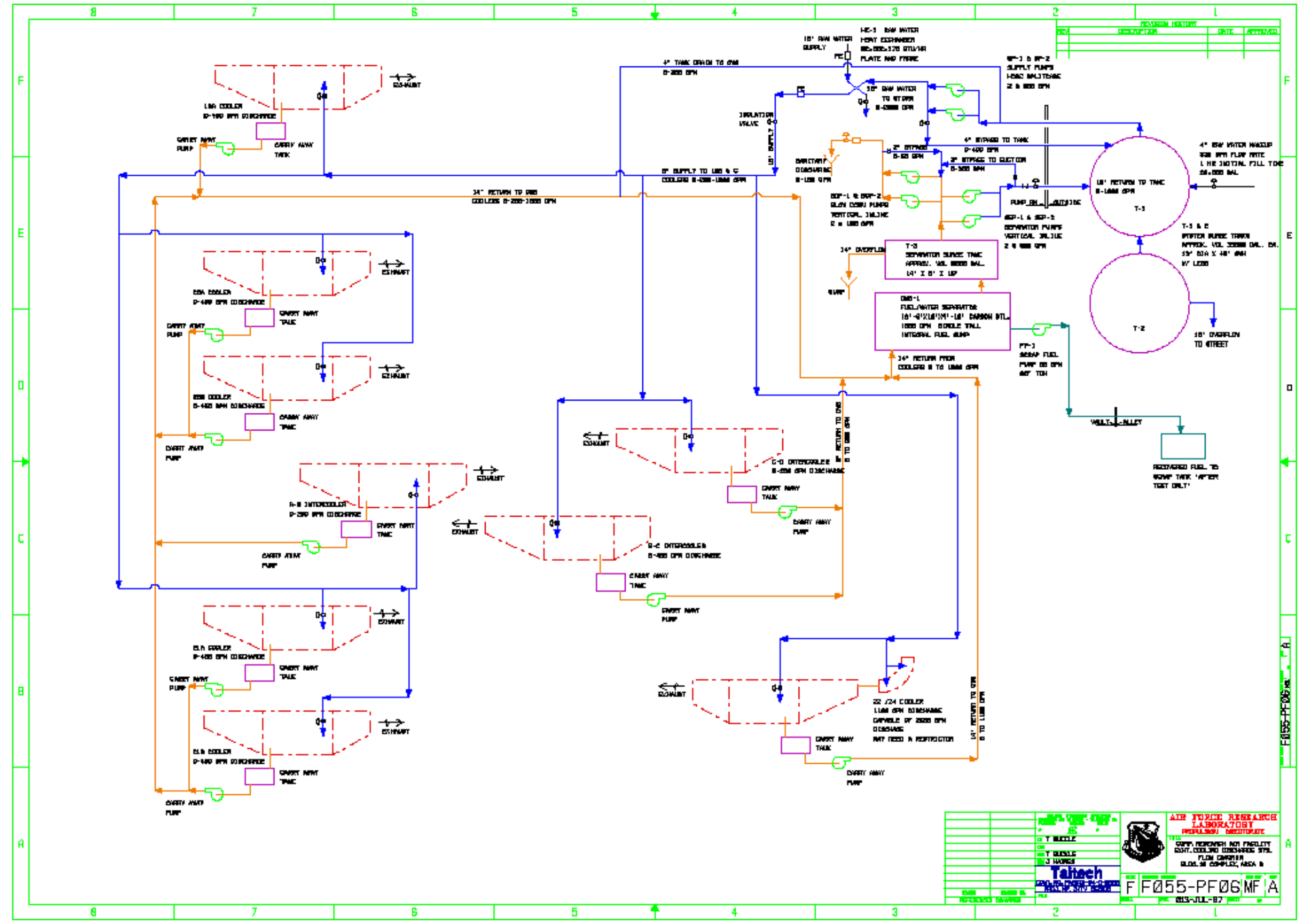
- OWS – removes free product
- Clay towers – remove emulsified fuel
- Pros
  - Recycles water
  - Can meet storm water compliance or can discharge to existing sanitary
  - No chemical handling
- Cons
  - Replacement of clay & waste disposal
  - Freezing problems
  - Fuel in recycled water

# Selection Parameters (1 Lowest , 4 Highest)

| | Initial Costs | Annual/ Recurring | Installation months | Risk |
|---|---|---|---|---|
| Sanitary Line | 3 | 1 | 3 | 1 |
| Closed Loop | 2 | 3 | 2 | 2 |
| OWS with Clay | 1 | 3 | 1 | 3 |
| DAF | 4 | 2 | 4 | 4 |

# Preferred Option

- **Closed Loop**
  - **Can it actually be accomplished?**
- **Additional Details**
  - **Estimate fuel concentration in recycled water**
    - Can it safely be recycled to cool exhaust?
    - Can water be recycled without clay?
  - **Can existing sanitary line be used?**
  - **How much water needs to be stored for release to sanitary?**
  - **Infrastructure limitations**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# Fuel Concentration

- **4000 ppm average (200 gal fuel, 50,000 gal water)**
- **Not to exceed 15,000 ppm**
- **Measured concentration in trial run**
  - —600 ppm time 0
  - —250 ppm time 2hrs
- **Water with emulsified fuel can be recycled safely without clay polishing**

# Sanitary Line

- **OWS ensures free product capture**
- **Sanitary line survey conducted**
  - —Existing line - <200 gpm discharge acceptable
- **Flashpoint test**
  - — > 140 F for emulsified fuel
- **Discharge temperature**
  - — < 70 F
- **Existing line can be used for discharge**

# Water Storage

- 60,000 - 100,000 gallons
- 2 or 3 tanks 35,000 gallons each

# Infrastructure Limitations

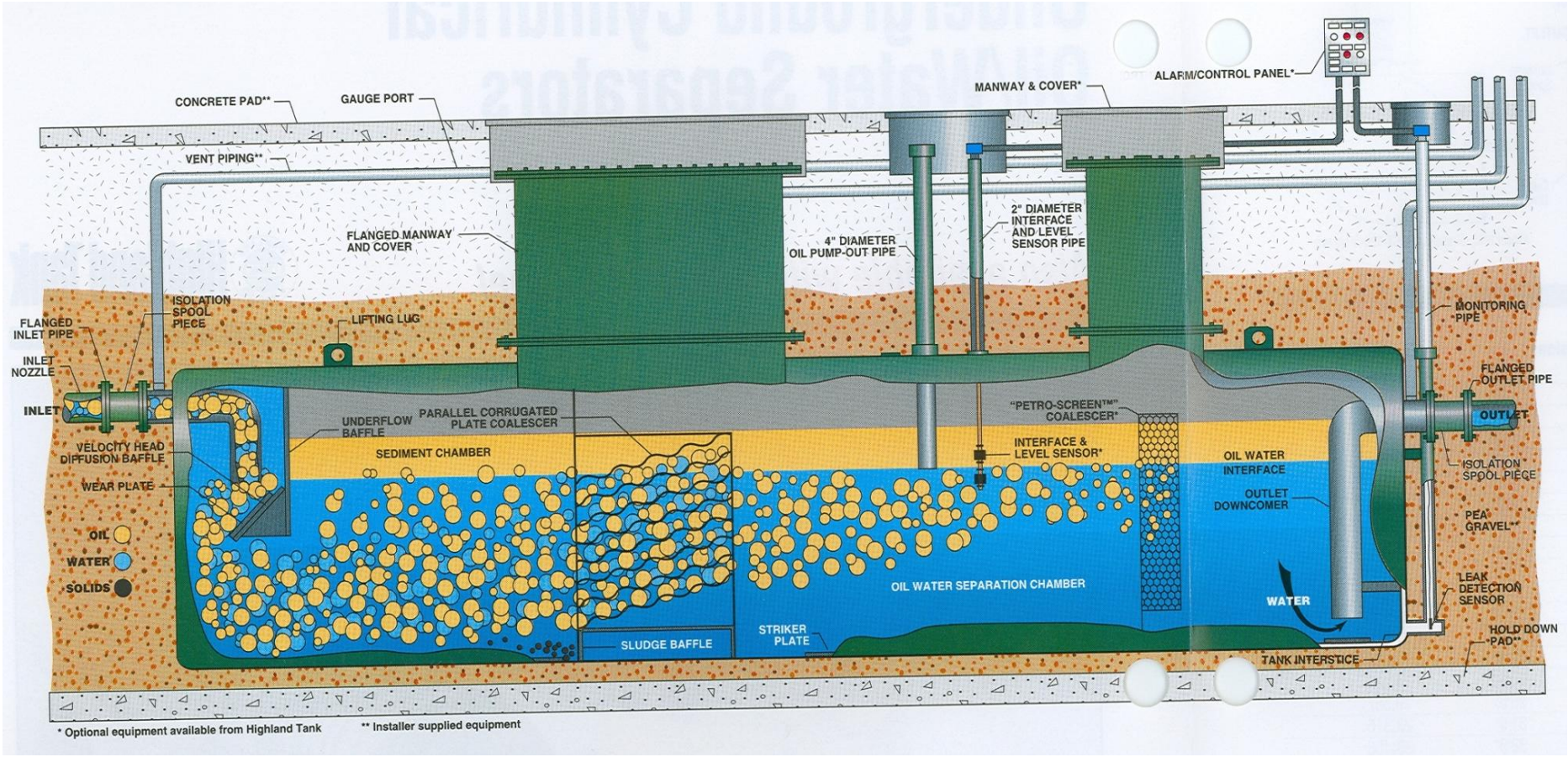
- **Location of 1500 gpm OWS**
- **Location of 35,000 gallon towers**


Pacific Wood Laminates, Inc.


Highland

# Conclusion

- **Closed Loop System can be accomplished**
  - —Unique combination of OWS, two-35,000 gallon storage tanks, recirculation of water to cool the exhaust and low flow controlled discharge to sanitary sewer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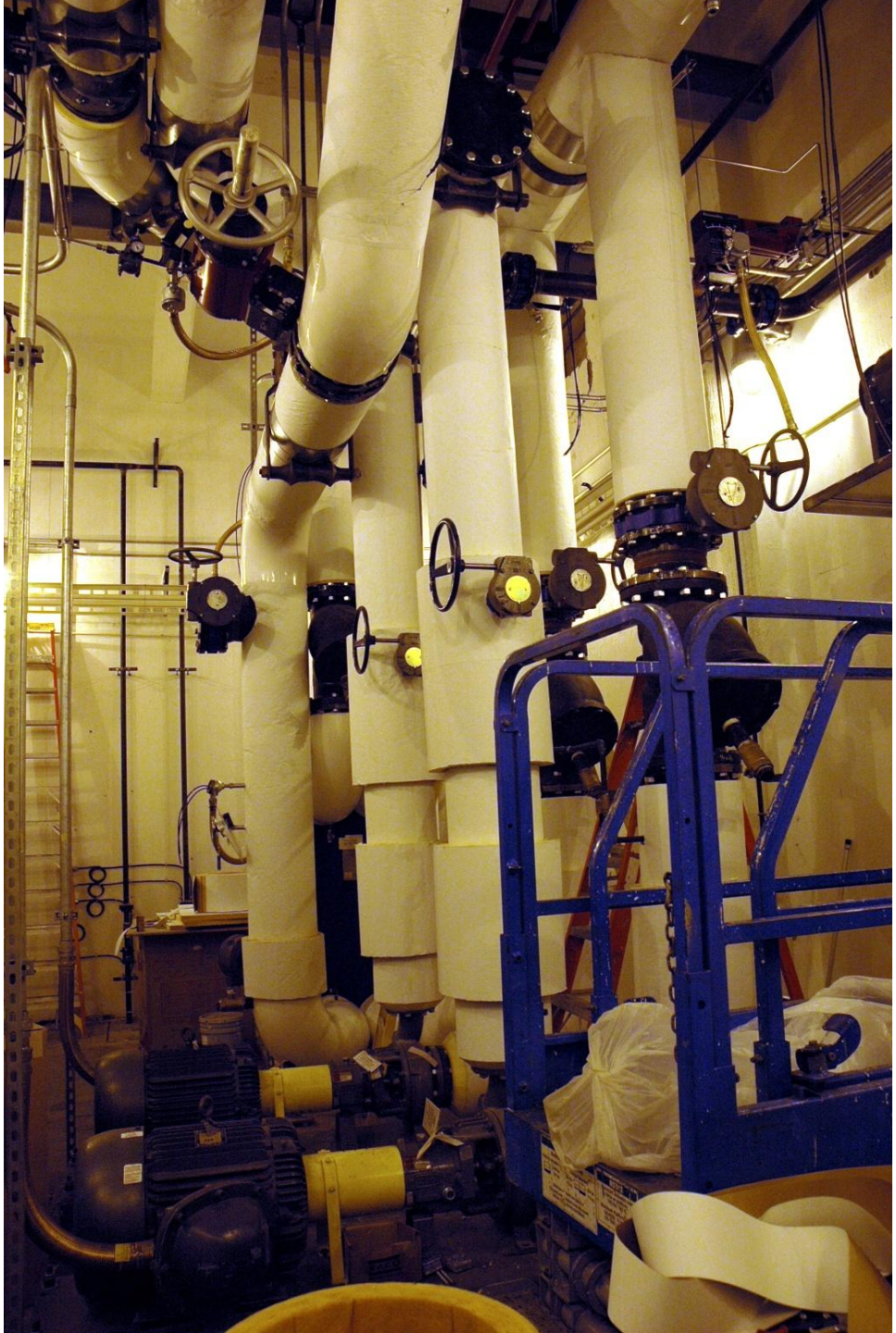


EXIT
CAUTION
M3
M4

# Conclusion (Cont)

- **Recirculation saves approximately 20M gallons of water/year**